Natural Heritage & Endangered Species Program

Commonwealth of Massachusetts
Division of Fisheries & Wildlife
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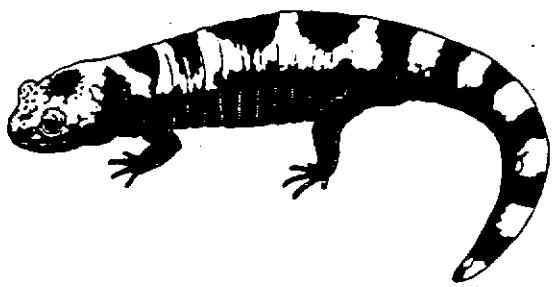
MASSACHUSETTS THREATENED SPECIES

Marbled Salamander
(Ambystoma opacum)

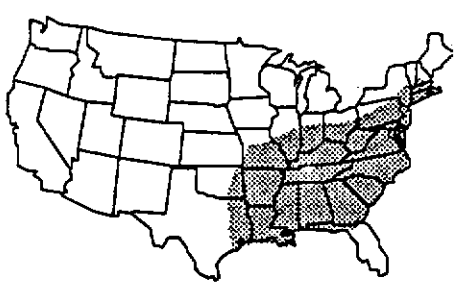
DESCRIPTION: The Marbled Salamander is short and stout, with a stocky body, short limbs, and a broad, rounded snout. The front limbs have four digits while the back have five. Dark brown to black background dorsal color is splashed with bold silver-white or grey bandlike markings that converge to create black spots—the "marbled" effect which earned the salamander its common name. Unique among the New England salamanders, Marbleds exhibit sexual dichromatism; the males have brilliant white markings while the females' are dull grey. Sometimes the cross-banding is incomplete, forming stripes on the back, sides, and tail. The ventral coloration is uniformly dark gray. Markings are notaby brighter and more distinct in males than in females. Recently-transformed juveniles average about 4 cm (1.5 in) in total length and have a dark grey to brown coloration with tiny silver flecks scattered over the dorsal area. As the animal matures, these flecks elongate to form the characteristic adult pattern. Adults vary in length from 9 cm (3.5 in) to 10.75 cm (4.25 in.), with the males slightly shorter than the females. The tail comprises about 40 percent of the total length of the body.



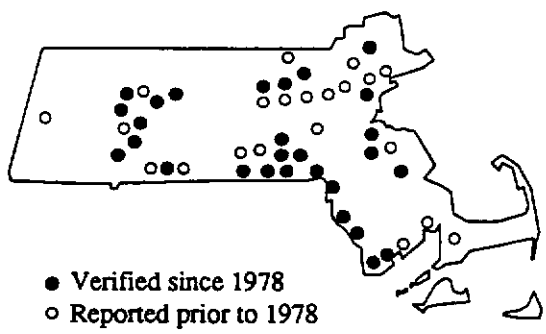
DeGraaf, R.M., and D.P. Rudis. Amphibians and Reptiles of New England. University of Massachusetts, Amherst. 1983.

SIMILAR SPECIES IN MASSACHUSETTS: Mature, adult Marbled Salamanders are very distinct, so confusion with other species is unlikely. Young adults are similar to young adult Spotted and Blue-spotted Salamanders, but are distinguished by their silver rather than gold or blue dorsal flecking.

RANGE: The Marbled range in New England includes southern New Hampshire, Massachusetts (except for Suffolk County and the Islands), Connecticut, and Rhode Island. From this northern extreme the range broadens greatly, extending down through southern New York and central Pennsylvania, west to southern Illinois and down through the Mississippi basin to eastern Oklahoma and eastern Texas. The eastern border expands south throughout the Southeast down to northern Florida and the Gulf.



Range of the Marbled Salamander



Breeding Distribution in Massachusetts

HABITAT IN MASSACHUSETTS: Marbled Salamanders are largely terrestrial and generally occur in deciduous to mixed woods of the southern hardwood type, dominated by oak and hickory species with White Pine. They can live in a variety of habitats including moist, sandy areas and dry hillsides. They hide beneath surface materials such as logs, bark, boards, stones, and drift that piles up along the margins of streams. Wooded vernal pools or shallow depressions are required for breeding sites.

LIFE CYCLE/BEHAVIOR: Unlike most other *Ambystoma* species which breed in the spring (mid March to April), Marbled Salamanders breed and deposit their eggs in autumn (September to October) in dry vernal pools. During the late summer, on nights just after heavy rainfall, Marbled adults migrate to the edges of dry vernal pools and congregate under the leaf litter. Males generally arrive at the breeding sites a few days prior to the females. Courtship occurs on land, involving circular "dancing" and snout-to-vent nuzzling. This activity induces the males to deposit a gelatinous spermatophore (a tiny packet of sperm) on the ground which is then picked up and stored in the female's cloaca for internal fertilization. Eggs are spherical and opaque, between 2.7 and 5 mm in diameter. Numbering between 50 and 150, the eggs are deposited individually in a nest, usually in a small cavity under a log or leaf litter on the bottom of a vernal pool depression. They are almost invariably flooded when autumnal rainwater fills the pool. The moist eggs become covered with leaf detritus and become difficult to detect. The female remains to guard the eggs, curling her body protectively around them until they hatch.

Eggs hatch within a few days after water fills the depression. Newly-hatched larvae are .75 inches in length in the fall and remain active through the winter under ice, growing slowly. If the pool doesn't fill, the female will leave the eggs for an underground wintering lair. Eggs are capable of withstanding extended desiccation without mortality, and in some cases, may overwinter to hatch the following spring. Larvae from eggs that overwinter, grow larger before hatching, emerging at a full inch long. In the spring, growth acellerates for all larvae as temperatures increase and food items become more abundant. Larvae are voracious eaters, preying on copepods, aquatic insects and their larvae, other amphibian larvae, and even each other.

The schedule of larval metamorphosis is largely dependent on vernal pool water levels during summer. In years of high water, larvae remain in the pool longer, sometimes until fall, before transforming. The recently-metamorphized young salamanders leave the pond as adults arrive to breed. Young salamanders take a year to a year and a half to reach breeding size. Adult Marbled Salamanders feed on small invertebrates such as larval and adult insects and crustanceans, snails, earthworms, slugs, beetles and ants. They are nocturnal and generally less active than other salamander species. Adults have a distasteful secretion that protects them from potential predators.

POPULATION STATUS IN MASSACHUSETTS: The Marbled Salamander is currently listed as a "Threatened Species" in Massachusetts. Forty-three current populations (1978 to the present) in 29 locations have been documented, as well as 28 historical populations (prior to 1978) in 26 locations. The fact that the Marbled is near the northern limit of its range in Massachusetts is a contributing factor to its rarity in the state. Furthermore, the species is difficult to locate and census accurately. Although Marbled Salamanders are widespread throughout Massachusetts lowlands, populations are very small and localized, surrounding vernal pool breeding areas. For yet unknown reasons, many vernal pools do not support them. The major threat to this species—and most salamanders in general—is the loss of wetland habitat to development and urbanization. Some population declines may be attributed to sample overcollection, heavy road traffic near breeding pools, and pesticide application or other toxic chemicals. Studies on the adverse effects of acid rain on salamander eggs and larvae have been contradictory, and further studies must be made to resolve this issue.

MANAGEMENT RECOMMENDATIONS: In order to ensure the survival of this species in Massachusetts, the following recommendations regarding habitat preservation are suggested. There are two critical components in the life history of this species: the vernal pool habitat required for reproduction, and the upland forest habitat required for foraging, hibernation and other terrestrial and fossorial activities. Conservation of the Marbled Salamander (and all native members of the genus *Ambystoma*) must therefore focus on the preservation of vernal pools and small ponds known to be inhabited by this species, as well as a significant parcel (250 - 1600 meter radius) of upland habitat surrounding such breeding sites. Provided these habitats are not significantly degraded (and that the salamanders are not subject to illegal collection or high road mortality), the salamander populations should be capable of maintaining themselves indefinitely.

It should be kept in mind, however, that every population is unique. The majority of the population, for instance, may be concentrated in a relatively small and discrete upland habitat, which would safely allow carefully conducted development within some portions of the "uninhabited" habitat around the breeding pool without serious effects on the population. The only way to determine if such a case exists, however, is through a detailed environmental study conducted by a qualified researcher(s) over a series of years, charting the movements of the animals to and from the breeding site. Unless such a study is conducted, it should be assumed that the salamanders are relatively evenly distributed around the pool and development should be strongly discouraged within a minimum radius of 500 - 1,000 meters surrounding the breeding pool.

Vernal pools and breeding pond must be protected not only from draining, filling and development, but also from degradation in the form of road and lawn run-off. If lumbering is conducted within surrounding areas, a no-cut buffer zone of 50 to 100 feet should be established around the pool depression, and no slash or other debris should be dumped in the depression. Vernal pools receive some protection under the Massachusetts Wetlands Protection Act and several vernal pool species (including the Marbled Salamander) are protected under the Massachusetts Endangered Species Act. Efforts should be made register all vernal pools, and to enhance and promote the enforcement of the laws mentioned above. Because of their ephemeral nature, vernal pools are often difficult to locate during dry periods, and may be inadvertently damaged if their locations are not surveyed and marked prior to lumbering or construction operations.

Citizens must be encouraged to recognize and report Marbled Salamanders and the locations of their breeding pools. Due to the rarity of this species, its ephemeral terrestrial occurrence, and its very specific habitat requirements, some populations undoubtedly remain undiscovered and therefore underprotected. Interested citizens with access to vernal pools should also be encouraged to monitor the annual production of their local salamander populations, as such data may prove invaluable in detecting population trends as well as catastrophic changes. Finally, citizens and landowners should be made aware that breeding pools degraded through pollution, drainage or filling can often be restored to some extent, and the possibility of reintroducing native species to such habitats should be investigated.

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NOTE: Vernal pools that are certified by the Natural Heritage and Endangered Species Program (NHESP) may be protected by the Massachusetts Wetlands Protection Act. If you would like more information about vernal pool certification, contact NHESP to obtain copies of the documents entitled "Guidelines for Certification of Vernal Pool Habitat," along with "Vernal Pool Field Observation Forms."

Vernal pools constitute a unique and increasingly vulnerable type of wetland that is inhabited by many species of wildlife, some of which are ENTIRELY dependent on vernal pool habitat for one or more stages of their life cycle. Two-thirds of the Commonwealth's rare amphibians (4 of the 6 species) are totally dependent upon vernal pools for breeding.

(continued overleaf)

SUGGESTED GUIDELINES FOR TIMBER HARVESTING NEAR VERNAL POOLS

Vernal pools provide critically important habitat for a number of rare and endangered species in Massachusetts. Certain precautions should be taken when harvesting in the vicinity of such pools to minimize impacts and preserve the character and physical environment that these species require. Although these pools may only actually be filled with water for a brief period of time in the spring, the most important measure that can be taken to protect the habitat is to recognize pool locations even in the "dry" season and take precautions to preserve the local environment around the pools. Recognizing these seasonal pools and considering the following guidelines will help protect these critical habitats:

1. Heavy equipment should not be permitted in vernal pool depressions at any time of the year. Avoid locating landings, skid roads, or haul roads through or near these depressions. It is important that the depressions not fill in with sediment from nearby areas of disturbed soil.

2. Similarly, do not stack logs or otherwise create soil compaction in vernal pool depressions.

3. Avoid operating logging machinery within approximately 50 feet of a vernal pool during mud season. Ruts deeper than 6 inches can disrupt migration routes of endangered salamanders. There should be no ruts deeper than 6 inches within 200 feet of a vernal pool. Similarly, the actual vernal pool depression should not be physically altered so that its ability to seasonally hold water is impaired.

4. Tree tops or slash should not be allowed to fall or be placed into vernal pool depressions. While many amphibians use downed woody material to attach their eggs to, no additional material should be added to a pool. If tops or branches do fall into a depression, they should be removed. Similarly, existing natural woody material should NOT be removed from vernal pool depressions.

5. It is important that the temperature and relative humidity at the soil surface be maintained in the cool, moist condition necessary for amphibians that use vernal pools. Thus, it is important that these vernal pools, and an area within 50 feet of these pools, be maintained in a shaded and mostly undisturbed condition.

   a. Do not clearcut these areas. Some forest cover must be maintained to provide continuous shade and protection from high temperatures at the soil surface. Do not leave only trees with small or damaged tops, or those that appear to be dead or dying. Established understory vegetation such as mountain laurel, hemlock, or naturally established advanced regeneration can provide shade. Similarly, shade can be provided by vigorous hardwood sprouting following a harvest.

   b. Avoid disturbance of the mineral soil within 50 feet of a vernal pool depression for several reasons. First, it is important that sediment not accumulate in vernal pool depressions. Second, the exposure of mineral soil removes the natural insulation provided by the accumulated litter on the forest floor. This litter can be several inches thick and can keep actual soil moisture and temperature from getting too high, even if exposed to direct sunlight. For these reasons, it would be best to operate in the vicinity of vernal pool depressions when the ground is frozen and covered with snow. Under other dry conditions, it would be advisable to not operate machinery within 50 feet of a pool depression, and to winch timber (if any is cut within this radius) out of this area. Finally, it would be advisable not to operate within 50 feet of a vernal pool depression during mud season, so as to not create ruts.

Partially funded by a grant from DEM Forest Stewardship Program